LARVAL AND ADULT FOOD PLANTS FOR SOME TROPICAL SATYRINE BUTTERFLIES IN NORTHERN QUEENSLAND

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Abstract

A list of larval and potential larval food plants for six species of tropical Satyrinae is presented based on field observations in northern Queensland during 1989-93. Literature documenting larval foods for all Australian tropical Satyrinae is summarised. Larvae of two species, *Mycalesis perseus* (Fabricius) and *Melanitis leda* (Linnaeus), are recorded on many grasses and are probably opportunistic. Oviposition behaviour is briefly described; direct egg-laying on the leaves of the food plant appears characteristic for this group of butterflies. Comments are made on adult feeding for nine taxa. Nectar feeding appears to be widespread, except *Mycalesis* spp., and is particularly frequent in the smaller species *Ypthima arctous* (Fabricius) and *Hypocysta adiante* (Hübner). *Mycalesis terminus* (Fabricius) regularly feeds on rotting fruits, but *M. sirius* (Fabricius) does not seem to utilise this resource. *M. perseus* and *M. leda* may also feed on rotting fruits.

Introduction

The larval food plants of the Australian Satyrinae (Lepidoptera: Nymphalidae) are poorly known. This is particularly evident amongst the tropical species for which very little reliable information is available; for some taxa such as *Hypocysta adiante* (Hübner), *H. pseudirius* Butler, *Mycalesis perseus* (Fabricius) and *Orsotriaena medus* (Fabricius) no food plants are recorded from the field (Common and Waterhouse 1981). Waterhouse (1923) noted that the larval food plants of *Melanitis leda* (Linnaeus), *Ypthima arctous* (Fabricius), *Hypocysta metirius* Butler, *H. pseudirius* and *H. adiante* comprised grasses, while Manski (1960) listed *Imperata* (blady grass) and other course grasses (Poaceae) for seven species (*M. leda*, *Tisiphone helena* (Olliff), *Mycalesis terminus* (Fabricius), *M. sirius* (Fabricius), *Y. arctous*, *Hypocysta irius* (Fabricius), *H. metirius* Butler). The reliability of part of Manski's list, however, has been questioned by the failure of larvae of at least one taxon, *T. helena*, to accept *Imperata* as a food plant (Braby 1993), and Valentine (1988) has stated that *M. sirius* do not lay on this grass but prefer *Panicum maximum* Jacq. Edwards (1948) and Common and Waterhouse (1981) listed *Cynodon dactylon* (L.) Pers. (couch grass) for *H. metirius*, and De Baar (1981) reared both *H. adiante* and *Y. arctous* in captivity on *Imperata cylindrica* (L.) Beauv., *Digitaria didactyla* Willd. and *Themeda triandra* Forssk. (Poaceae). More recently, Moore (1986) studied oviposition behaviour in *M. terminus* and *M. perseus* and found that females oviposit on a range of grasses, although the two species showed substantial differences in selectivity with respect to food quality. Wood (1984, 1988) recorded the palm *Calamus caryotoides* Mart. (Arecaceae) for *Elymnias agondas* Boisduval and *Tetrarrhena* sp. (Poaceae) for both *Hypocysta angustata* Waterhouse & Lyell and *H. irius*,

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Table 1. Summary of larval food plants recorded for satyrine butterflies in northern Queensland, 1985, 1989-93. Number of records refers to the number of occasions in which the immature stages were recorded on that plant species. * = Species introduced to Australia. + = G. Moore (*pers. comm.*).

Satyrine species	Larval food plant	No. of records	Comments
Mycalesis perseus	*Themeda triandra* Forsskal	9	4 eggs laid, 3 larvae (instar IV-V), 2 pupal exuviae (Townsville, Cardwell)
"	*Dichanthium sericeum* (R.Br.) A. Camus	4	3 eggs laid, 2 larvae (instar IV) (Townsville)
"	*Heteropogon triticeus* (R.Br.) Stapf & Craig	2	2 eggs laid, 1 larva (instar V)
"	*H. contortis* (L.) Roemer & Schultes	1	1 egg laid+ (Townsville)
"	**Panicum maximum* Jacq.	2	1 egg laid, 1 larva (instar V) (Townsville, Rollingstone)
"	*Aristida calycina* R.Br.	1	1 egg laid+ (Townsville)
"	*Brachiara* sp.	1	1 egg laid+ (Townsville)
"	*Sporobolis* sp.	1	1 egg laid+ (Townsville)
"	*Eriachne* sp.	1	1 egg laid (Seaforth)
"	grass sp.1	1	2 eggs laid (Mt. Elliot Nat. Park)
"	grass sp.2	1	1 egg laid (Mt.Elliot Nat. Park)
Mycalesis terminus	*Oplismenus aemulus* (R.Br.) Roemer & Schultes	1	1 egg laid (Rollingstone)
"	*Oplismenus* sp.	4	6 eggs laid (Townsville, Bartle Frere)
"	*Dichanthium sericeum*	3	4 eggs laid, 1 larva (instar I) (Townsville)
"	**Panicum maximum*	2	5 eggs laid (Townsville, Rollingstone)
"	**Axonopus compressus* (SW.) P. Beauv.	1	3 eggs laid+ (Townsville)
"	*Themeda triandra*	1	1 egg laid (Cardwell)
"	grass sp.1	1	1 egg laid (Townsville)

Mycalesis terminus	grass sp.2	1	1 egg laid (Seaforth)
"	*Flagellaria indica* L. (Flagellariaceae)	1	1 egg laid (Wenlock River, C.Y. Peninsula)
Mycalesis sirius	*Themeda triandra*	2	8 eggs laid (Cardwell)
"	*Ischaemum australe* R.Br.	2	8 eggs laid (Rollingstone)
"	**Panicum maximum*	1	1 egg laid (Cardwell)
"	grass sp.	1	1 egg laid (Cardwell)
Melanitis leda	**Panicum maximum*	5	all stages (Townsville, Cape Cleveland, Majors Creek, Kennedy)
"	*Imperata cylindrica* (L.) P. Beauv.	3	1 egg laid, 23 larvae (various instars) (Kennedy, Cape Cleveland, Cardwell)
"	*Ophiuros exaltatus* (L.) Kuntze	3	all stages (Mt. Elliot Nat. Park, Cardwell)
"	*Themeda triandra*	3	4 eggs laid, 1 pupal exuvia (Mt. Elliot Nat. Park, Townsville, Byfield)
"	*Heteropogon triticeus*	2	1 pupa, 2 pupal exuviae (Cardwell)
"	**Melinis minutiflora* P. Beauv.	1	20 larvae (Kennedy)
"	*Sorghum* sp.	1	3 eggs (Cape Cleveland)
"	*Chrysopogon* sp.	1	1 larva (instar V) (Innot Hot Springs)
"	*Paspalidium* sp.	1	2 eggs laid (Byfield)
"	grass sp.	1	1 larva (instar V) (Townsville)
Hypocysta metirius	*Eriachne pallescens* R.Br.	1	3 eggs laid (Paluma)
"	grass sp.	1	2 eggs laid (Paluma)
Hypocysta adiante	*Themeda triandra*	1	1 egg laid (Cardwell)

while Braby (1993) confirmed that the sedge *Gahnia sieberiana* Kunth (Cyperaceae) is the natural food plant of *T. helena*. For *M. leda*, De Baar (1983) and Hawkeswood (1990) recorded larvae on *Panicum maximum*, the latter author also reared larvae on *Paspalum dilatatum* Poir. (Poaceae), while S.J. Johnson (*in* Dunn and Dunn, 1991) listed *Sorghum verticilliflorum* (Steudel) Stapf. Waterhouse (1932) and Common and Waterhouse (1981) also listed paspalum, buffalo grass (*Stenotaphrum secundatum* (Walter) Kuntze), blady grass (*Imperata* sp.), millet and sugar cane (*Saccharum* sp. probably *officinarum*) for *M. leda*. Dunn (1993) recently added *Leersia hexandra* Swartz for *M. leda*.

In this paper a list of larval food plants for six tropical satyrines is presented. Comments are also made on adult feeding behaviour. The records contribute substantially to the biology and natural history of these butterflies.

Materials and methods

The records presented on larval and adult food plants were based mainly on incidental observations during extensive field studies throughout northern Queensland, from Rockhampton to Cape York, in 1989-93. Observations were obtained for 10 of the 14 satyrines which occur in this region, the four species for which no records were made were *E. agondas*, *O. medus*, *H. angustata* and *Heteronympha merope* (Fabricius). Many of the larval records were made whilst watching ovipositing females, particularly between Townsville and Cardwell. The food plant records are presented in summarised form[1] and include Moore's (1985) unpublished work for two species studied at Townsville. Larval food records for *Tisiphone helena* are excluded as these are presented elsewhere (Braby 1993). Detailed observations were also made on adult feeding behaviour, and these are commented upon in only general terms[1]. A feeding record was defined where an individual(s) was observed to visit a food source for at least 5 sec. and uncoil the proboscis into the food.

Results

Larval food plants

Observations on larval foods (comprising 69 records in total) were obtained for six species, viz. *M. perseus*, *M. terminus*, *M. sirius*, *M. leda*, *H. adiante* and *H. metirius*, and these are summarised in Table 1. The immature stages of the first four species were recorded on a wide range of grasses, while only one or two observations were made for *H. adiante* and *H. metirius*. The larval diets of two species, *M. perseus* and *M. leda*, were broad with 11 and 10 grass species recorded respectively. *M. perseus* appeared to favour *Themeda triandra* (37.5% of all records for this species), while *M. leda* appeared to favour *Panicum maximum* (23.8% of all records for this species); on one occasion over 100 larvae were counted on this plant. Only eggs were recorded

[1] A more detailed list including information on locality, date and time of observation for each record is available on request from the author.

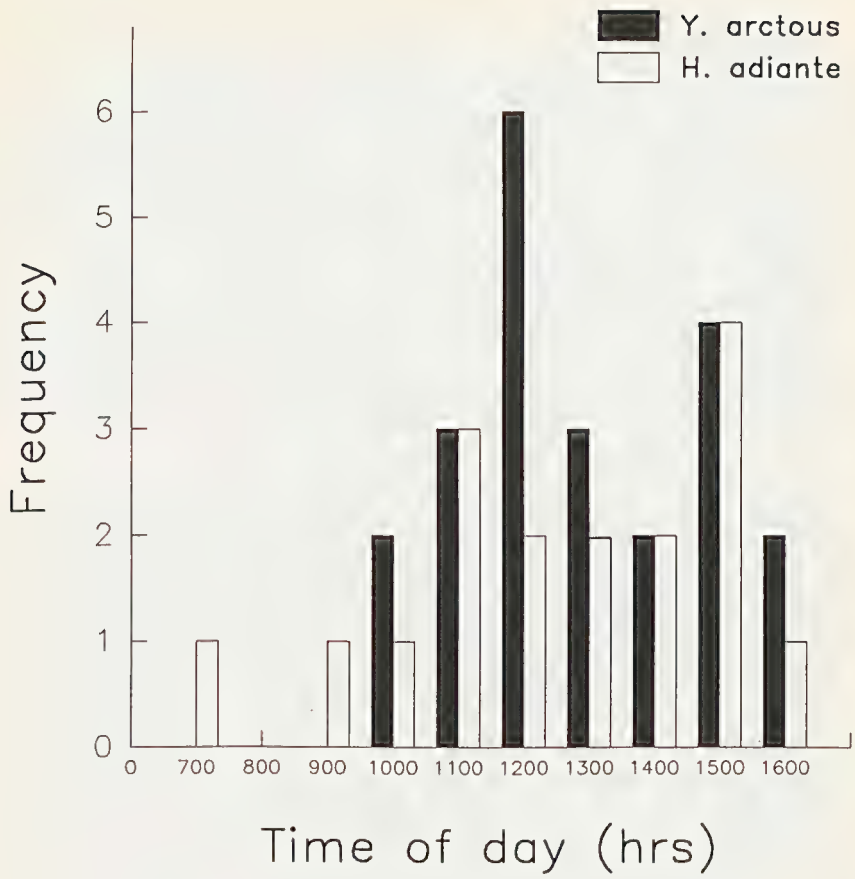

Fig. 1. Diurnal frequency distribution of the number of records of nectar feeding in two adult satyrines, *Ypthima arctous* and *Hypocysta adiante*. Feeding records are grouped into hourly intervals.

for the remaining four satyrines, and their larval plant preferences cannot be inferred from the few egg-laying observations. *M. terminus* may favour *Oplismenus* spp. (33% of all records for this species), grasses which grow in damp areas in rainforest edges where the butterfly typically occurs. One observation was also made of a female *M. terminus* ovipositing on the rainforest grass-like vine *Flagellaria indica* (Flagellariaceae). Although only two records were obtained for *M. sirius* on *Ischaemum australe*, this may be an important food plant because the grass grows commonly in the paperbark swamplands where adult *M. sirius* typically occur (Braby 1995a): on one

occasion seven eggs were deposited on this grass by several females over a 13 minute observation period.

In all species where eggs were found or where egg-laying was observed, females generally deposited their eggs singly on the underside of green grass blades, usually on younger (softer) growth, although *M. terminus* and *M. sirius* appeared less selective in this regard. *M. leda* usually deposited its eggs in small groups of up to five. Most butterfly females alighted on the leaf above and curled the abdomen underneath the leaf to oviposit. *M. leda* was an exception to this behaviour in that the females would orientate themselves under the leaf and hang upside down while laying. In *M. perseus*, *M. terminus* and *M. sirius* most oviposition observations were recorded in the afternoon and only one *M. terminus* female was observed to lay in the late morning; two eggs were laid at Rollingstone during overcast conditions. Eggs were laid only at dusk in *M. leda*.

Adult food plants

Adult feeding was observed in nine satyrine species (with 65 records obtained in total), viz. *M. perseus*, *M. terminus*, *M. sirius*, *Y. arctous*, *H. adiante*, *H. metirius*, *H. irius*, *H. pseudirius* and *T. helena*, but was not recorded in *M. leda*. Nectar feeding was widespread and particularly common in the smaller species *Y. arctous* and *H. adiante*. These two butterflies were observed feeding on flowers from a wide range of plant families and combining all records on a diurnal basis revealed that feeding occurred throughout the day, though more often in the afternoon or at midday than during the early morning, particularly in *Y. arctous* (Fig. 1). Nectar feeding appeared less common in *H. metirius* (5 records), was rarely observed in *H. irius*, *M. perseus*, *M. sirius* and *T. helena* (with 3, 3, 1 and 1 records for each respectively) and was not recorded at all in *M. leda* and *M. terminus*. Only two records of nectar feeding were obtained for *H. pseudirius*, but the few observations may reflect the fact that this species is comparatively rare in northern Queensland and consequently less frequently observed in the field.

M. terminus, by contrast, was often recorded feeding on fallen rotting fruits, including those of *Pandanas whitei* Martelli (Pandanaceae), introduced *Mangifera indica* L. (Anarcardiaceae), *Nauclea orientalis* (L.) L. (Rubiaceae) and *Ficus racemosa* L. (Moraceae); on several occasions large numbers of adults (>30) were observed feeding at these resources. On one occasion this species was also noted attending a sap flow of *Planchonia careya* (F. Muell.) Kunth (Lecythidaceae). *M. perseus* appeared to visit fallen rotting fruits less frequently than *M. terminus* and only two records of adult feeding were made (on *Mangifera indica* and *Pandanus* sp.). *M. sirius* and *M. leda* were not recorded feeding on rotting fruit, but the latter species has been observed on occasions feeding on this resource (R.E. Jones, *pers. comm.*). Both *M. terminus* and *M. perseus* were also observed on several occasions to drink from droplets of water early in the morning.

Discussion

Caution must be taken in interpreting apparent preferences and diet breadth of larval foods from observations of this sort because the records are incidental and the sampling effort was not quantitatively distributed across potential foods or habitats. Moreover, most of the records were made while watching ovipositing females and therefore further caution should be taken over suitability of these species because butterfly females occasionally make 'mistakes' (Singer 1984 and references therein, Kitching and Zalucki 1983) so further work is needed to investigate various components of offspring fitness such as larval success. Nevertheless, limited observations suggest larvae do indeed feed on a range of plant species; in captivity I reared *Mycalesis* spp. larvae on several grasses including *Panicum maximum*, *Themeda triandra* (Braby and Jones 1994) and *Imperata cylindrica*, but late instars of these species also successfully accepted the sedge *Gahnia sieberiana*. This may indicate that larvae are broad opportunistic oligophages, though females probably rarely lay on Cyperaceae in the field.

The larval diet of at least two species, *M. perseus* and *M. leda*, appears particularly broad, especially in the latter species if the records are combined with all previously recorded food plants (see Introduction). [Many of the plants listed in Table 1 were recorded with larvae and pupae indicating successful development on these foods]. This relatively wide range may reflect their reproductive strategies; both species are opportunistic breeders during the wet season when grasses are green (Braby 1995b).

In contrast to many temperate northern hemisphere satyrines which rarely deposit their eggs on the leaves on which their larvae later feed (Wiklund 1984), the six satyrines for which observations were made deposited their eggs directly onto the leaves of the plants. The behaviour also occurs in another four Australian tropical satyrines (Wood 1984, 1988, Braby 1993). Most eggs were laid singly, but Moore (1985) found that *M. terminus* occasionally lays eggs in batches of up to seven. The apparently undiscriminating strategy of temperate species is thought to be a result of the super-abundant nature of their food plants (mostly grasses), because newly hatched larvae have a high probability of food encounter regardless of where eggs are laid (Wiklund 1984). However, since grasses are also super-abundant in tropical habitats there may be different selective forces operating on tropical satyrines and Moore (1986) has argued that greater available search time may have promoted a higher degree of selectivity in tropical species. There may also be differences in various ecological factors, such as food quality and the extent of predation/parasitism of eggs, between temperate and tropical habitats which could account for differences in the oviposition strategies adopted by these two satyrine groups.

Common and Waterhouse (1981) noted that the adults of Australian satyrines sometimes visit flowers to feed, but precise details have rarely been recorded.

Amongst the tropical species nectar feeding appears widespread and was particularly common in two species, *Y. arctous* and *H. adiante*. These butterflies were recorded feeding from a wide range of flowers, some of which are introduced, suggesting opportunistic behaviour. Apparent tendency of *Y. arctous* and *H. adiante* to feed more frequently around midday and afternoon may reflect sampling bias, daily variation in nectar flow, or more likely diurnal changes in butterfly activity patterns (Braby 1995a).

By contrast *M. terminus* does not appear to feed on nectar but seems to specialise on rotting fruits. Valentine (1982, 1988) has noted that *M. terminus* and also *M. leda*, are attracted to rotting fruit and that adults will feed for long periods from fallen mangoes or other soft fruits. The species also can be trapped regularly in the field by setting baits of rotting fruit (Moore 1985, Braby 1995a). This feeding behaviour, however, does not seem to occur in *M. sirius* and was recorded only on a few occasions in *M. perseus*. However, Moore (1985) and Braby (1995a) have found that *M. perseus* is often attracted to rotting fruit by baiting so that this resource may be a more important component in the adult diet of this species than present records indicate.

The significance of these dietary sources in the biology and reproductive ecology of these butterflies warrents further investigation. In *M. terminus* females, for instance, availability of rotting fruit in the adult diet appears to play an important role in producing better quality offspring (Braby and Jones 1995).

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